International Journal of EXERCISE SCIENCE

Original Research

A Description of Physical Activity Outcomes during Beginning Curling

BRITTON JOHNSON‡[1], ALYSSA VANBELKUM*[1], and JUSTIN KRAFT‡[1]

[1]Department of Health, Physical Education and Recreation, Missouri Western State University, St. Joseph, MO, USA

*Denotes undergraduate student author, †Denotes graduate student author, ‡Denotes professional author

ABSTRACT

International Journal of Exercise Science 11(6): 633-639, 2018. Identifying and promoting activities which enable participants to meet exercise guidelines is important for promoting a healthy society. The purpose of this study was to describe activity levels of novice participants during participation in the sport of curling. Participants included 29 novice curlers who were either enrolled in a beginning curling class at a local university or novice members in a city-wide curling league. The average exercise duration was 81.3 ± 19.8 minutes and variables monitored included heart rate (HR), steps, and estimated METs. Results indicated an average HR: 106 ± 12 bpm, peak HR: 146 ± 20 bpm, 3114 ± 927 steps, 2.1 ± 0.6 METs. Results indicate light to moderate levels of physical exertion during beginning curling. Moreover, step data indicated that beginning curling made a significant contribution (~30%) toward the 10,000 steps recommended daily.

KEY WORDS: Curling, intensity, heart rates, METs, step counts, accelerometry, exercise guidelines

INTRODUCTION

Curling is a sport where a 42 pound stone is thrown down a sheet of ice to a target about 140 feet away. The target is a set of rings surrounding the "button", which is the center of the "house." Teammates may "sweep" the ice to help the stone either to not slow down as fast, or to not curl as quickly. The goal is to get your stone(s) closer to the button than the other team.

Curling became an Olympic sport in 1924 (men's only), but received official status for only that Olympic Games. The sport was included as a "demonstration sport" in several other Olympic games, including 1932, 1988 and 1992. Curling found its way officially back into the Olympics in 1998 (both Men's and Women's). The sport's popularity began to increase in the United States after the United States won a Bronze Medal at the 2006 games in Torino (27). There are roughly 1.3 million people around the world who participate in curling, around two-thirds of which are Canadian (15). In 2014-2015, membership in the USA Curling topped 20,000 members for the first time (20,384) (26).

The benefits of physical activity are well known, and there are numerous ways to become physically active, including walking, housework, yard work and various sports or games. Often times, people will become more physically active if they have others who will participate with them. This is why sports have become a popular version of physical activity. However, the competitive nature of sports can sometimes work as a deterrent to participation. Children, as well as adults, will often be deterred by the focus on winning as opposed to participation and health benefits (8). Thus, individuals may choose not to participate, instead remaining sedentary, due to the stress of competitive sports. Therefore, finding activities that can be performed with friends, while not focusing on the competition can be crucial to the activity levels of the individuals. (8). Curling likely meets several of the aforementioned characteristics as individuals within a team must function as a highly cooperative unit with much of the focus on the team's own task execution (as the two teams do not engage directly within the sport, as they do in football or basketball). Moreover, the structure of activity may also impact activity levels. Studies have shown that physical activity levels drop when physical activity time is not offered regularly (9). For example, Physical Education and Recess increased physical activity levels in children by 20% or more. This includes increasing steps by 1100 per day when in Physical Education class (5, 18). The requirements of curling (specialized equipment and team nature) encourage the practice of the sport within a league dynamic which produces regular commitment to the activity (13)

A number of studies have examined the physical activity levels of various activities and sports including curling. These studies have utilized heart rate monitors, accelerometers to estimate MET's, and step counts in order to determine the effectiveness in meeting current exercise guidelines (14, 1, 2). These studies have shown that curling requires an output of about 4 MET's, similar to that of walking at 3.5 mph, bicycling about 10mph, water aerobics, walking in golf, and walking while carrying an infant (2). However, these studies were performed with experienced curlers, while widespread participation is a relatively new phenomena as the sport of curling has only gained popularity in the United States in the past several years after exposure in the winter Olympics. This means that most curlers are relatively new to the sport. Therefore, it is useful to know if curling effectively contributes to the recommended 30 min of "moderate" physical activity and 10,000 – 13,000 steps amongst novice participants (20). Therefore, the purpose of this study was to describe physical activity outcomes among participants who are beginning curlers.

METHODS

Participants

Participants included 29 beginning curlers (24 male and 5 female) who were either enrolled in a beginning college curling class for the first time, or first time members of newly formed city-wide curling league. All participants were those who had never played the sport prior to enrollment in the course or the league. This study was approved by the Institutional Review Board (IRB) of Missouri Western State University. Each participant signed a consent form before participating in the study. These participants were not required to participate and received no benefit from their involvement. Descriptive statistics are included in table 1.

Protocol

Participants were initially measured for descriptive statistics (height and weight). Participants were then fitted with the biometric devices (HR monitors, accelerometers, and pedometers). Participants then completed their curling session as normal with no intervention from the researchers. All participants were monitored for only one session (average of 81 minutes) and were asked to participate as normally as possible. In this manner, behavior was typical of routine game play. Due to limited equipment, no more than four individuals were monitored during a given session. However, all sessions were similar in structure. Upon the close of the curling session, participants returned the biometric devices to the researchers for data download.

Usable heart rate (HR) data was obtained for a subset of the participants (n=15) via a polar HR monitor (Polar Inc., Port Washington, NY). Step count was estimated via a pedometer (StepWatch 3 Step Activity Monitor; Orthocare Innovations, Mountlake Terrace, WA) which was worn on the ankle during participation. Energy expenditure (in METs) was estimated via accelerometry (GT3X; Actigraph, Pensacola, FL) with the device worn at the waist on the dominant side. The accelerometers were triaxial accelerometers that register movement in each axis in "counts" which are then used to calculate estimated METs via the Actigraph Analysis Software. METs were estimated utilizing the Swartz Adult Overground and Lifestyle algorithm (25). As suggested in previous research, the accelerometer was placed so as not to interfere with the physical activity (3). None of the data collection interfered in the game play in any way.

Table 1. Sample descriptive statistics.

Gender	n	Height (M)	Weight (KG)	Age (years)	BMI
Male	24	1.78 ± 0.07*	85.2 ± 14.5	25.4 ± 9.6	26.7 ± 4.0*
Female	5	1.70 ± .05	70.8 ± 9.6	24.3 ± 4.5	24.4 ± 2.2

* indicates descriptive data calculated for 23 subjects

Statistical Analysis

The mean and standard deviation was calculated for session duration, mean HR, peak HR, total steps, and mean estimated METs. All statistical analysis was performed on SPSS statistical software.

RESULTS

The average exercise duration was 81.3 ± 19.8 min. Mean and standard deviations for mean HR, peak HR, total steps, and mean METs estimated via accelerometry are reported in Table 2.

Table 2. Means and Standard Deviations for mean HR, Peak HR, Total Steps, and Estimated METs.

Mean HR	Peak HR	Total Steps	Estimated METs
106 ± 12 bpm*	146 ± 20 bpm*	3114 ± 927	2.1 ± 0.6

* indicates n = 15 for HR data calculations

DISCUSSION

ACSM exercise guidelines classify exercise between 55-69% of maximum HR as moderate in nature (19). In this study, the mean HR of novice curlers was 106 BPM. To put this in context, the average age predicted maximum HR of the 15 participants for which HR data was reported was 195 ± 8 BPM. A mean HR of 106 BPM then represents 54% of the age predicted max. Therefore, while the activity level elicited by curling for these novice participants would technically be classified as "light", the true intensity level was on the border of the "moderate" intensity zone.

Moreover, mean HR may not fully capture the exercise stimulus due to the intermittent nature of curling. The peak heart rate of the individuals was 146 BPM or 74% of the age predicted maximum HR. The substantial difference between mean HR and peak HR can likely be attributed to the nature of curling game play which is characterized by alternating periods of activity and inactivity. Thus, the pattern of difference between mean HR and peak HR values would seem to correspond with natural game play. For instance, when a player's team is active, it appears they tended to work rather hard. However, when the other team is active, there was little to no activity involved. Thus, there are periods of higher level activity, followed by periods of low activity. These low activity periods will necessarily influence a mean value but not a peak value. As such, one should consider both mean and peak values when trying evaluate activity levels during curling. Overall, while beginning curling may not have provided a long and continuous period of time within the moderate intensity zone, the peak HR values obtained indicated that active periods clearly provided a significant exercise stimulus. The overall physical activity levels can go up and down during a curling match. However, the increased activity levels for the shorter bursts will accumulate as activity time increases. Given that curling participation generally runs between 90 minutes and three hours, this can lead to a substantial amount of moderate to vigorous activity during the contest.

The mean estimated MET value for the exercise session was 2.1 METs. This physical activity outcome would classify as "very light" to "light" depending on the age of the participant (19). Examples of activities that have moderate to low MET values (≤3.0 Mets) according to Ainsworth et al. 2000 include walking the dog, mild stretching, and picking fruits and vegetables. Again, it is possible that this mean estimated MET value underestimates the true exercise value. Accelerometers register movement "counts" which are then used to calculate an estimated MET value. This type of measurement would necessarily be affected by low activity periods with little movement.

On the other hand, total step data indicated that participation in beginning curling can make a significant contribution toward meeting the 10,000 – 13,000 daily step recommendation (20). On average participants accomplished 3114 steps (~30%) within the curling sessions (duration of 81 min). Furthermore, the intermittent nature of curling does not influence total step count as a marker of activity or create the same difficulties in interpretation as mean values. Therefore, total steps may be an excellent means of examining physical activity outcomes in future studies involving curling.

Results indicated that curling had a positive impact on exercise levels. In fact, curling for novice participants seemed to provide a substantial exercise stimulus from which these participants can benefit. While this activity may not have the same gains as running, swimming or weight training, there is a distinct team aspect to the sport that adds an element of fun. This is a very important factor to consider given its link to exercise adherence (12). By including the increased steps, and activity requirements of curling for beginners, it shows that curling does in fact raise activity levels while including social interactions such as teamwork and sportsmanship. Also, participants can make the activity more or less strenuous based on their interest level and competitiveness by working harder while sweeping. Hence, curling can be a valuable contributor for those seeking new exercise options and the growth of curling as a sport should be encouraged.

This study showed beginning curlers performed light to moderate physical activity, but future research may want to see if activity levels go up as these curlers become more advanced (i.e. they may sweep more, take more steps as they become more comfortable on the ice, and even have less down time). It is reasonable that when athletes begin to take the sport more seriously, they may experience greater exercise outcomes. Additionally, future research involving curling should consider which variables are most appropriate in assessing physical activity outcomes and it seems that total steps may be a valuable measure. Finally, future research may also want to examine the game modified for children (i.e. indoor sets) played during physical education classes. This may eliminate some of the sweeping component, thus lowering activity levels for the sport.

REFERENCES

1. Ainsworth BE, Haskell WL, Leon AS. Compendium of physical activities: classification of energy costs of human physical activities. Med Sci Sports Exerc 25(1):71–80, 1993.

2. Ainsworth BE, Haskell WL, Whitt MC. Compendium of physical activities: an update of activity codes and MET intensities. Med Sci Sports Exerc 32(9):S498–516, 2000.

3. Boerema, ST, van Velson, L, Schaake, L, Tonis, TM, Hermans, H.J. Optimal sensor placement for measuring physical activity with 3D accelerometer. Sensors (14), 2014.

4. Bradley, JL. The sports science of curling: A practical review. J Sports Sci Med 8(4): 495-500, 2009.

5. Brusseau TA, Kulinna PH. An examination of four traditional school physical activity models on children's step counts and MVPA. Res Q Exerc Sport 86(1): 88-93, 2014.

6. Center for Disease Control. http://www.cdc.gov/obesity/data/adult.html 2015.

7. Center for Disease Control. http://www.cdc.gov/obesity/data/childhood.html 2015.

8. Choi HS, Johnson BT, Kim YK. Children's development through sports competition: derivative, adjustive, generative, & maladaptive approaches. QUEST 66(20): 2014.

9. Fitness.gov Facts and Statistics. https://www.fitness.gov/resource-center/facts-and-statistics/ 2017

10. Gaya AR, Silva P, Martins C, Gaya A, Ribeiro JC, Mota J. Association of leisure time physical activity and sports competition activities with high blood pressure levels: study carried out in a sample of Portuguese children and adolescents. Child Care Health Dev 37(3):329-334, 2010.

11. Hamer M, Weiler R, Stamatakis E. Watching sports on television, physical activity, and risk of obesity in older adults. BMC Public Health 14:10. doi:10.1186/1471-2458-14-10 2014.

12. Herens M, Bakker EJ, van Ophem J, Wagermakers A, Koelen M. Health-related quality of life, self-efficacy and enjoyment. Keep the socially vulnerable physically active in community-based physical activity programs: A sequential cohort study. PLoS ONE 11 (2):1-29, 2016.

13. Kim D, Walker M, Heo J, Koo G. Sport league website: an effective marketing communication tool for corporate sponsors. Int J Sports Market Sponsorship 18 (3): 314-327, 2017.

14. Kozey SL, Lyden K, Howe CA, Staudenmayer JW, Freedson PS. Accelerometer Output and MET Values of Common Physical Activities. Med Sci Sports Exerc 42(9):1776–1784, 2010.

15. mic.comHere's Everything you ever wanted to know about curling. https://mic.com/articles/81947/here-s-everything-you-ever-wanted-to-know-about-curling#.SdAt4EmgV 2017.

16. Ogden CL, Carroll MD, Curtin LR, McDowell MA, Tabak CJ, Flegal KM. Prevalence of overweight and obesity in the United States, 1999-2004. JAMA 295(13): 1549-1555, 2006.

17. Pate RR, Davis MG, Robinson TN, Stone EJ, McKenzie TL, Young JC. Promoting physical activity in children and youth: a leadership role for schools: a scientific statement from the American Heart Association Council on Nutrition, Physical Activity, and Metabolism (Physical Activity Committee) in collaboration with the councils on cardiovascular disease in the young and cardiovascular nursing. Circulation 114(11):1214-1224, 2006.

18. Patience MA, Kilpatrick MW, Sun H, Watterson TA. Sports game play: a comparison of moderate to vigorous physical activities in adolescents. J Sch Health 83: 818-823, 2013.

19. Pollock ML, Gaesser GA, Butcher JD, Després JP, Dishman RK, Franklin BA, and Garber CE. ACSM position stand: The recommended quantity and quality of exercise for developing and maintaining cardiorespiratory and muscular fitness, and flexibility in health adults. Med Sci Sports Exerc 30(6):975-991, 1998.

20. Reed JA, Brittenham SW, Phillips DA, Carlisle CS. A preliminary examination of the fitness levels of children who meet the President's council physical activity recommendation. Physical Educator 64 (3):159-167, 2007.

21. Rowland TW, Freedson PS. Physical activity, fitness, and health in children: a close look. Pediatrics 93(4):669-672, 1994.

22. Sanders T, Cliff DP, Lonsdale C. Measuring Adolescent Boys' Physical Activity: Bout length and the influence of accelerometer epoch length. PLoS ONE 9(3): e92040. doi:10.1371/journal.pone.0092040, 2014.

23. Shephard RJ, Park H, Park S, Aoyago Y. Objectively measured physical activity and progressive loss of lean tissue in older Japanese adults: Longitudinal data from the Nakanojo study. J Am Geriatr Soc 61:1887–1893, 2014.

24. Smith L, Hamer M, Ucci M, Marmot A, Gardner B, Sawyer A, Wardle J, Fisher A. Weekday and weekend patterns of objectively measured sitting, standing and stepping in a sample of office-based workers: the active buildings study. BMC Public Health 15:9, 2015.

25. Swartz AM, Strath SJ, Bassett DR, O'Brien WL, King GA, Ainsworth BE. Estimation of energy expenditure using CSA accelerometers at hip and wrist sites. Med Sci Sports Exerc 32(9): S450-S456, 2000.

26. Teamusa.com 2015 Annual Report. http://www.teamusa.org/USA-Curling/Features/2016/July/28/2015-Annual-Report-now-available 2015.

27. World Curling Federation. http://www.worldcurling.org 2015.